

CDPS Analysis Methods

The 2000 CDPS model was developed using data from seven Fee-for-Service (FFS) State Medicaid programs. The model received major updates in 2009, using national FFS Medicaid data from 2002-2005, and in 2014, using additional national FFS Medicaid data from 2011. In 2016, ICD10 codes were incorporated into CDPS using the CMS General Equivalence Mappings from version 9 to 10. CDPS has also received regular annual updates to include the most recent ICD10 and NDC codes.

The 2000 CDPS model was developed using an iterative process that combined clinical and economic expertise. ICD9 codes were initially ordered within major categories corresponding to body systems (e.g., cardiovascular) or types of disease (e.g., diabetes). These codes were then combined, typically at the three-digit level, into stage 1 groups. Regression analysis was used to generate Ns and coefficients for these stage 1 groups, with the dependent variable being prospective cost. Several iterations of these regressions were reviewed by a team of clinical experts and economists and were used to create hierarchies of CDPS categories within major categories. The 2000 model had 58 CDPS categories withing 19 major categories. Categories higher in the hierarchy had greater coefficients and generally lower Ns than categories lower in the hierarchy.

A similar approach was used to develop the 2022 CDPS model. An initial run of the 2000 model using newer data from three national Medicaid managed care plans showed that some of the hierarchies were not maintained. Stage 1 groups were recreated using ICD10 codes for each of the affected major categories. Regression analyses were conducted for each major category after replacing the respective CDPS categories with stage 1 groups. Regression analyses were used to generate Ns and coefficients for these stage 1 groups, with the dependent variables being concurrent and prospective cost.

These regression results were reviewed to determine which stage 1 groups could be reordered to improve the hierarchy while maintaining clinical accuracy. For example, in the Psychiatric major category, the hierarchy was not maintained below PSYH for the SSI population, and the N for PSYL was significantly lower than for PSYML for all groups. Thus, we ran a regression excluding the Psychiatric CDPS categories and including 28 Psychiatric stage 1 groups. We kept the prior grouping for PSYH: F20 schizophrenia and F25, schizoaffective disorder. The PSYM category previously included F23 brief psychotic disorder, F28 other psychosis disorder, F29 unspecified psychosis, F31 bipolar disorder, F603 borderline personality disorder, F84 pervasive development disorder, and R44 hallucinations. Bipolar disorder had a relatively low coefficient and a high N and was thus moved to PSYL. Personality disorders (F60 and F69), F50 eating disorders, and F94 disorders of social functioning had moderate coefficients and were added to PSYM. The remaining stege1 groups originally assigned to PSYML were moved to PSYL.

The updated CDPS model was re-estimated after each reordering. In the case of Psychiatric, the result was an improved hierarchy among SSI and the largest N was now in PSYL. If the hierarchy

still appeared insufficient, for example if there is insufficient separation between the groups, then the stage 1 groups were revisited and reordered. Iterations of this process were continued until each major category had an acceptable hierarchy. Six CDPS major categories were revised: Psychiatric, Pulmonary, Renal, Cancer, Infectious Disease, and Hematological.

A summary of the revisions to each CDPS category is provided below.

MRX Analysis Methods

An initial run of the MRX model using newer data from three national Medicaid managed care plans showed that the model was stable over time. However, some MRX categories had very low or negative coefficients. As a result, the MRX categories for Eyes, Ears, Nose, and Throat, and Pain were dropped from the model. In addition, the MRX categories for Inflammatory /Autoimmune and Multiple Sclerosis / Paralysis were limited to the more expensive medications found in the restricted MRX model used for CDPS+Rx.

Several MRX categories related to infectious disease were incorporated into the MRX hierarchy: medications related to CMV Retinitis and HIV were combined with medications under Infections High, medications related to Hepatitis and Tuberculosis were combined with medications under Infections Medium, medications related to Herpes were moved to Infections Low, and the medications previously under Infections Low were dropped from the model.

Finally, a new category was created for Rare Diseases. This category includes medications that are used in patients with a disease state prevalence of less than 20,000 in the United States and in which the drug cost is \$150,000 or more for the average weight and dosing.

Summary of CDPS Revisions by CDPS Major Category

Here we provide a summary the revisions to each CDPS category.

Psychiatric

In the Psychiatric major category, the hierarchy was not maintained below PSYH for the SSI population, and the N for PSYL was significantly lower than for PSYML for all groups. Thus, we ran a regression excluding the Psychiatric CDPS categories and including 28 Psychiatric stage 1 groups. We kept the prior grouping for PSYH: F20 schizophrenia and F25, schizoaffective disorder. The PSYM category previously included F23 brief psychotic disorder, F28 other psychosis disorder, F29 unspecified psychosis, F31 bipolar disorder, F603 borderline personality disorder, F84 pervasive development disorder, and R44 hallucinations. Bipolar disorder had a relatively low coefficient and a high N and was thus moved to PSYL. Personality disorders (F60 and F69), F50 eating disorders, and F94 disorders of social functioning had moderate

coefficients and were moved to PSYM. The remaining stage1 groups originally assigned to PSYML were moved to PSYL.

Pulmonary

In the Pulmonary major category, the hierarchy was not maintained for PULH and PULM. Thus, we ran a regression excluding the Pulmonary CDPS categories and including 31 Pulmonary stage 1 groups. We kept the prior grouping for PULVH: E84 cystic fibrosis and Z codes for tracheostomy, lung transplant, and dependence on a respirator. The PULH category now includes J150_1 pseudomonas, J80 respiratory distress, Q30_4 respiratory malformations, and R092 respiratory arrest. Several stage 1 groups previously in PULL had moderate coefficients and were moved to PULM: B97 coronavirus, J15X bacterial pneumonia, J90_4 pleurisy, J985 mediastinitis, and J986 disorders of diaphragm.

Renal

In the Renal major category, the hierarchy was not maintained below RENEH. Thus, we ran a regression excluding the Renal CDPS categories and including 13 Renal stage 1 groups. We kept the prior grouping for RENEH: Z992 dependence on renal dialysis. N18 chronic kidney disease had a moderate coefficient and was moved to RENM. As a result, the CDPS category RENVH was dropped from the model. N31 neuropathic bladder also had a moderate coefficient and was moved to RENM. RENL now includes N13 vesicoureter-reflex and N39 other bladder disease.

Cancer

In the Cancer major category, the hierarchy was not maintained for CANM and CANL. Thus, we ran a regression excluding the CANM and CANL and including 33 Cancer stage 1 groups corresponding to those categories. Most of these stage 1 groups indicate malignant neoplasms in specific areas of the body. As a result, many were moved from CANM to CANL. CANM now includes malignant neoplasms related to C38 cardiac, C39 respiratory, C40_1 bone, C49 connective tissue, C60_3 male genital, C69 eye, and C77 lymph nodes. The remainder of the malignant neoplasms were previously in CANL or were moved to CANL along with C81 Hodgkin lymphoma, CC83_6X non-Hodgkin lymphoma, and C91 hairy cell leukemia.

Infectious Disease

The hierarchy was not maintained in the Infectious Disease major category. Thus, we ran a regression excluding the Infectious Disease CDPS categories and including 29 Infectious Disease stage 1 groups. As a result, we decided to drop the separate CDPS identifiers for AIDSH and HIVM and created CDPS categories for INFVH, INFH, INFM, and INFL. The new INFVH category includes most of the stage 1 groups previously included in AIDSH and INFH. INFH now includes the stage 1 groups B20 HIV and Z16 resistance to antibiotics. Several stage 1 groups previously

in INFL had moderate coefficients and were moved to INFM. INFL now includes B02 zoster and B15_9 hepatitis.

Hematological

In the Hematological major category, the hierarchy was not maintained below HEMEH. Thus, we ran a regression excluding the Hematological CDPS categories and including 7 Hematological stage 1 groups. We kept the prior grouping for HEMEH: D66_7 hereditary factor deficiency. HEMVH now includes D60_1 aplastic anemias. HEMM includes D55_9 hemolytic anemias, D570_1 sickle cell anemia, and D70_6 blood disorders. HEML includes D75X sickle cell disease and D65_9 coagulation defects.